

REMARKS

Claims 1-19 are pending. No new matter has been added by way of the present submission. For instance, claims 4 and 5 have been amended to clarify certain features of the present invention. Such features are supported by the present specification as filed. Illustratively, the following limitations are supported as defined below:

1. a maximum surface pore size is 15 μm or less, see line 21 on page 11 in the present specification;
2. the ratio A^1/A^2 of an average pore size at one surface A^1 to an average pore size at the other surface A^2 is from 0.6 to 1.5, see lines 17-23 on page 14;
3. a maximum inside pore size is 5.1 μm or less, see Table 1-1;
4. the average surface porosity C has an average porosity C^1 of from 50% to 80% at one surface and an average porosity C^2 of from 50% to 80% at the other surface, see Table 1-1 at page 30 and lines 5-8 on page 12;
5. the average inside porosity D is from 45% to 80%, see line 23 on page 11 to line 1 on page 12; and
6. the ratio C^1/D of C^1 to D is in the range of 0.7 to 1.5 and the ratio C^2/D of C^2 to D is in the range of 0.7 to 1.5, see the description "the ratio C/D of C to D is in the range of 0.7 to 1.5" at lines 10-11 on page 4 in the specification, and an average rate of surface hole area C includes an average rate of hole area C^1 at one surface, and an average rate of hole area C^2 at the other surface as disclosed in lines 17-19 on page 4 in the specification.

Also, new claims 10 and 11 have been added and are substantially supported by claims 4 and 5 as well as the following illustrative locations in the present specification:

1. a maximum surface pore size is 15 μm or less; and the ratio A^1/A^2 of an average pore size at one surface A^1 to an average pore size at the other surface A^2 is from 0.6 to 1.5, same support as stated above;
2. the ratio A/B of A to B is in the range of 0.6 to 1.5; and the average inside pore size B is from 0.5 to 16.7 μm , supported as described below;
3. the average surface porosity C has an average porosity C^1 of from 50% to 80% at one surface and an average porosity C^2 of from 50% to 80% at the other surface, same support as stated above;
4. the average inside porosity D is from 45% to 80%, same support as stated above; and
5. the ratio C^1/D of C^1 to D is in the range of 0.8 to 1.3 and the ratio C^2/D of C^2 to D is in the range of 0.8 to 1.3, supported as described below.

Illustrative support for the above limitations 2. and 5., is as follows: "The ratio A/B of the average surface pore size A to the average inside pore size B and the ratio C/D of the average rate of surface hole area C to the average rate of inside hole area D are ... more preferably from 0.6 to 1.5 and from 0.8 to 1.3, respectively" in lines 20-25 on page 13 in the present specification. In the original claims 4 and 5, the average surface pore size A is 0.7 to 10 μm . When $A/B=0.6$, it is calculated that $B=0.7\mu\text{m}/0.6=1.2\mu\text{m}$ to $10\mu\text{m}/0.6=\underline{16.7\mu\text{m}}$, and when $A/B=1.5$, it is calculated that $B=0.7\mu\text{m}/1.5=\underline{0.5\mu\text{m}}$ to $10\mu\text{m}/1.5=6.7\mu\text{m}$. Therefore, when $A/B=0.6-1.5$ and $A = 0.7-10 \mu\text{m}$, B is 0.5 to 16.7 μm . Further, as mentioned above, an average

rate of surface hole area C includes an average rate of hole area C^1 at one surface, and an average rate of hole area C^2 at the other surface as disclosed in lines 17-19 on page 4 in the specification. Lastly, newly added claims 12-19 are supported by Table 1-1 at page 30 and lines 5-8 on page 12 as well as lines 17-19 at page 4 of the present specification.

Accordingly, Applicants submit that no new matter has been added.

In view of the following remarks, the Examiner is respectfully requested to withdraw all rejections and allow the currently pending claims.

Issues Under 35 U.S.C. §§ 102/103(a)

The Examiner has rejected claims 4-9 under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Patel *et al.*, U.S. Patent Application Publication No. 2001/0023014A1 (hereinafter "Patel"). Applicants respectfully traverse this rejection.

The Present Invention and its Advantages

A film produced by conventional phase conversion techniques using a polymeric compound as a material has a skin layer (compact layer) on its surface and contains substantially no hole area (opening) or contains some openings with a low rate of hole area. In this regard the Examiner is referred to page 1, last line to page 2, line 4 of the present specification.

An object of the present invention is to provide a porous film having a high rate of hole area at its surfaces and containing homogenous micropores overall from the surfaces to the inside thereof (see lines 15-18 on page 2 in the present specification).

After intensive investigations to achieve the objects, the present inventors have found that a porous film having homogenous micropores with a high rate of hole area even on a surface of the film which has been in contact with a substrate can be prepared by casting a solution mixture containing a polymer onto a substrate to form a film and subjecting the film to phase conversion, in which the difference in surface tension between the polymer and the substrate is at a specific level or more. The present invention has been achieved based on these findings (see line 21 on page 2 to line 5 on page 3 in the present specification).

In the present invention, a porous film with a high surface porosity of from 50% to 80% on average is produced in a method comprising the steps of casting a polymer solution comprising a polymer onto a substrate to form a film; and subjecting the film to phase conversion to thereby form a porous film, wherein the polymer constituting the porous film has a surface tension S_a [mN/m], wherein the substrate has a surface tension S_b [mN/m], and wherein S_a and S_b satisfy the following condition: $S_a - S_b \geq -10$ (claims 4, 5, 10 and 11).

Distinctions Between the Present Invention and Patel

In Patel, the examination results, typical pore size and pore density, given by SEM of the resulting coatings are shown in the table of paragraph [0100] of Patel. Average surface porosities of the resulting coatings are calculated on the basis of the results of typical pore size and pore density, as follows:

Test Polymer	Typical Pore Size (μm)	Pore Density (mm^{-2})	Pore Density (μm^{-2})	Area per one Pore (μm^2)	Area of Pores per $1\mu\text{m}^2$ of Coating (μm^2)	Average Surface Porosity (%)
GAF E735	0.2-0.4	1.2×10^6	1.2	0.031-0.13	0.038-0.15	<u>3.8-15</u>
GAF E535	0.8-2.5	0.1×10^6	0.1	0.50-4.9	0.050-0.49	<u>5.0-49</u>
K-15	1.2-4.0	0.2×10^6	0.2	1.1-13	0.23-2.5	<u>23-(250)</u>
K-30	2.4-4.5	0.01×10^6	0.01	4.5-16	0.045-0.16	<u>4.5-16</u>
K-90	0.3-0.5	2.0×10^6	2.0	0.07-0.20	0.14-0.40	<u>14-40</u>

As shown in the above Table, the average surface porosity in Patel is in the range of 3.8 to 49%, except for the reported 250% in K-15. Concerning this 250% reported value, Applicants submit that such a value is nonsensical as explained below.

It can be seen that the average surface porosity of 250% in K-15 is apparently obtained in the case of a typical pore size of 4.0 μm . When the typical pore size is 4.0 μm , it is calculated that the area per one pore is 13 μm^2 , and it should be calculated that the pore density is 0.08 μm^{-2} or smaller. Therefore, the pore density shown in Patel's table of 0.2 μm^{-2} in K-15 is incompatible.

In contrast, in currently pending claims 4, 5, 10 and 11, the average surface porosity C has an average porosity C^1 of from 50% to 80% at one surface and an average porosity C^2 of from 50% to 80% at the other surface. This clearly represents a significant distinction between the present invention and the disclosure of Patel.

Moreover, further distinctions exist. For instance, Patel teaches that the method comprises the step of drying the coating, and as a result of solvent evaporation, the coating solidifies in the form of film (in paragraph [0043]):

On the other hand, in the method of the present invention, it is preferred that the cast film is held in an atmosphere at relative humidity of 70% to 100% and temperatures of 15°C to 90°C for 0.2 to 15 minutes, and the film is brought to a solidifying liquid comprising a nonsolvent for the polymer component. The cast film is more preferably held at relative humidity of 90% to 100% and temperatures of 30°C to 80°C, and specifically preferably at relative humidity of about 100% (e.g., 95% to 100%) and temperatures of 40°C to 70°C. If the moisture content in the atmosphere is less than the above-specified range, the resulting film may have an insufficient rate of hole area.

By keeping the cast film under the above-mentioned condition, the film can have an increased rate of hole area specifically on a surface opposite to the substrate-side surface of the film (hereinafter may be referred to as "air-side surface of the film"). Indeed, **the rate of hole area is increased** because water (moisture) migrates from the surface into the core of the film and efficiently accelerates the phase separation of the solution mixture by holding the cast film under a humidified condition (see line 19 on page 9 to line 13 on page 10 in the present specification).

As mentioned above, the present method does not have the steps of drying the coating and solvent evaporation, and differs from the Patel's method in this respect.

Accordingly, the difference in the methods induces the difference in the property of the obtained film structure. It is therefore clear that not only does Patel fail to disclose the presently claimed porous film, but in fact, Patel fails to provide any method for obtaining the claimed porous film. Under such conditions there can exist neither anticipation nor obviousness of the presently claimed subject matter based upon Patel.

Further, Patel teaches that the method comprises the step of (e) washing the coating in an aqueous medium so as to extract at least 50% by weight of the said second polymer (claim 1), thereby render the coating microporous, and for a given loading of hydrophilic polymer in the initial coating, the degree of porosity of the final product is determined by the proportion of the hydrophilic polymer that is removed by the wash (in paragraph [0045]).

On the other hand, in the present invention, the water-soluble polymer and water are added so as to control the phase separation structure upon casting to thereby form a spongy, porous film structure (lines 22-24 on page 8 in the present specification). The present invention does not teach that the degree of porosity of the final product is determined by the proportion of the hydrophilic polymer that is removed by the wash. This represents an additional distinction.

In view of the above, Applicants believe the pending application is in condition for allowance. The Examiner is therefore respectfully requested to withdraw this rejection and allow the currently pending and examined claims.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Craig A. McRobbie Reg. No. 42,874, at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.


Application No. 10/534,411
Reply to Office Action of December 11, 2008

Docket No.: 3273-0202PUS1
Art Unit: 1794

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

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